

# Planning for Sustainable Water Supplies for US Army Installations

**Elisabeth Jenicek**

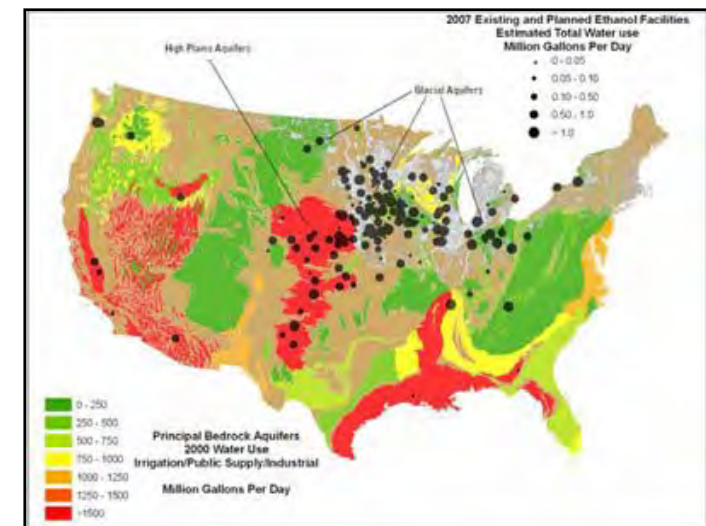
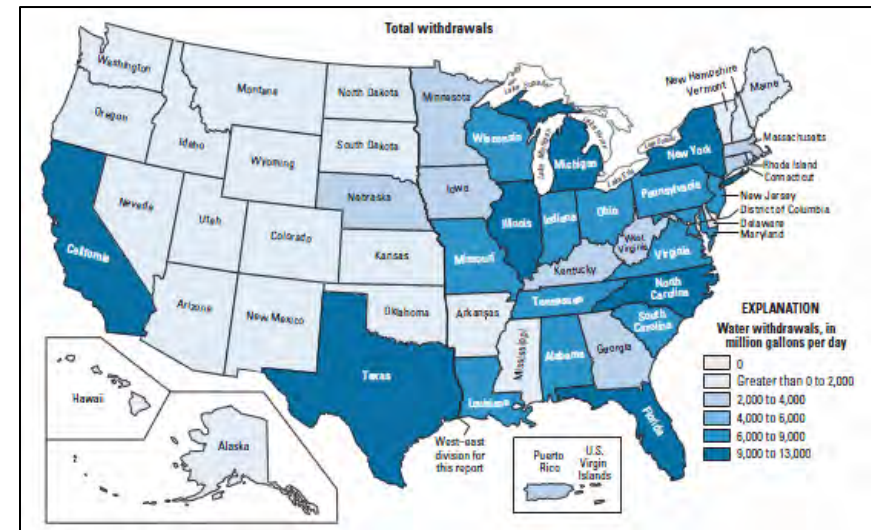
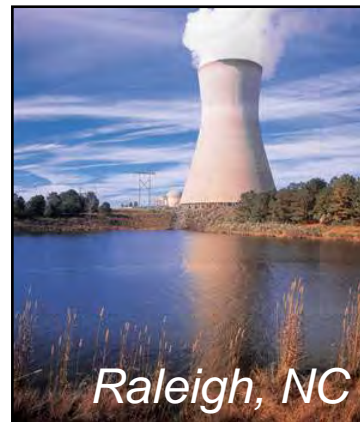
Mechanical Engineer/Regional Planner  
Engineer Research and Development Center

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE <b>OCT 2011</b>		2. REPORT TYPE		3. DATES COVERED <b>00-00-2011 to 00-00-2011</b>	
4. TITLE AND SUBTITLE <b>Planning for Sustainable Water Supplies for US Army Installations</b>				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>U.S. Army Corps of Engineers,Engineer Research and Development Center,Washington,DC,20314-1000</b>				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>					
13. SUPPLEMENTARY NOTES <b>Presented at the GreenGov Symposium, October 31 - November 2, 2011, Washington, DC</b>					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>Same as Report (SAR)</b>	18. NUMBER OF PAGES <b>14</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

# Energy/Water Nexus

- Thermoelectric power
- Geothermal
- Biofuels
- CSP i.e. Solar HW
- Hydropower
- Carbon Capture
- Fracking

*Kenney et al 2009 (USGS)*



# Aging Infrastructure

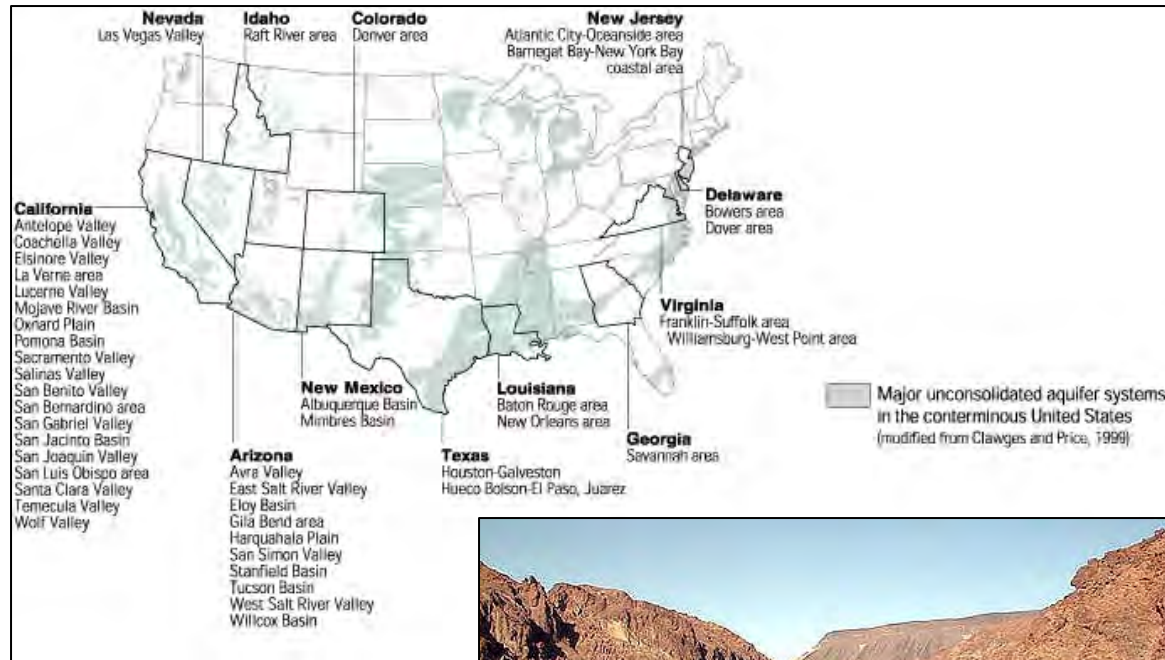
- 240,000 water main breaks/year.
- 1.7 trillion gal/year lost @ \$2.6.
- AWWA targets 15% unaccounted for water.
- ASCE Infrastructure Report Card: D-.
- EPA Gap Analysis: \$263B shortfall by 2020.



*Pew Center and EPA*



# Overwithdrawal



*When it comes to water, the past is no longer a reliable guide to the future.*

*~ Sandra Postel*

1999

Lake Mead, NV

Galloway et. al. 1999, Life, Inc., SunsetCities.com & Las Vegas Sun

# Complex Water Rights

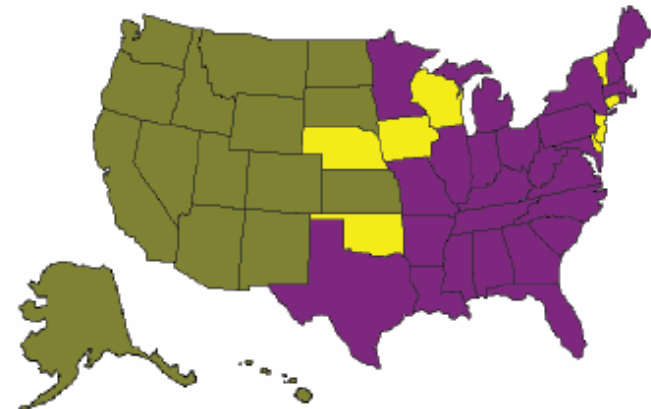
- Determined on the state level.
- Riparian: Eastern states, reasonable use.
- Prior Appropriation Doctrine: first in time, first in right; water rights can be sold.

- *Law of the River (Colorado River)*
- *Appalachicola/Chattahoochee/Flint*
- *Lake Lanier*
- *Tennessee River*
- *Great Lakes Compact*

"I wish to make it clear to you, there is not sufficient water to irrigate all the lands which could be irrigated, and only a small portion can be irrigated. I tell you, gentlemen, you are piling up a heritage of conflict."

-- Maj. John Wesley Powell, 1893

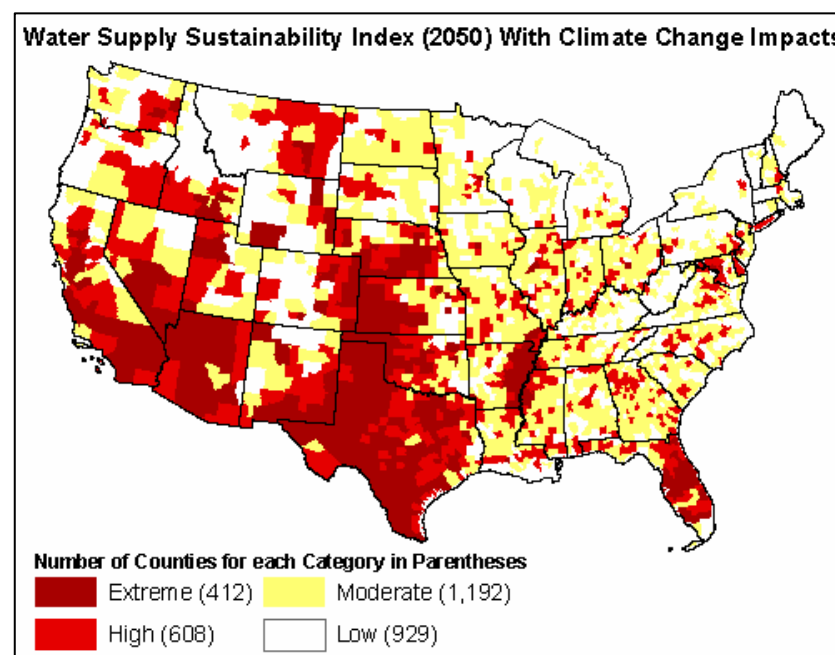
**Legal Allocation of Water:** 48% (shown in purple) of the 50 states allocate water by riparian rights of landowners and 38% (shown in green) by prior appropriation doctrine (the right to use the water). The other states (shown in yellow) have a mix of laws or some other type of authority.



ASDWA WAVS White Paper Feb2009

# Climate Change Impacts

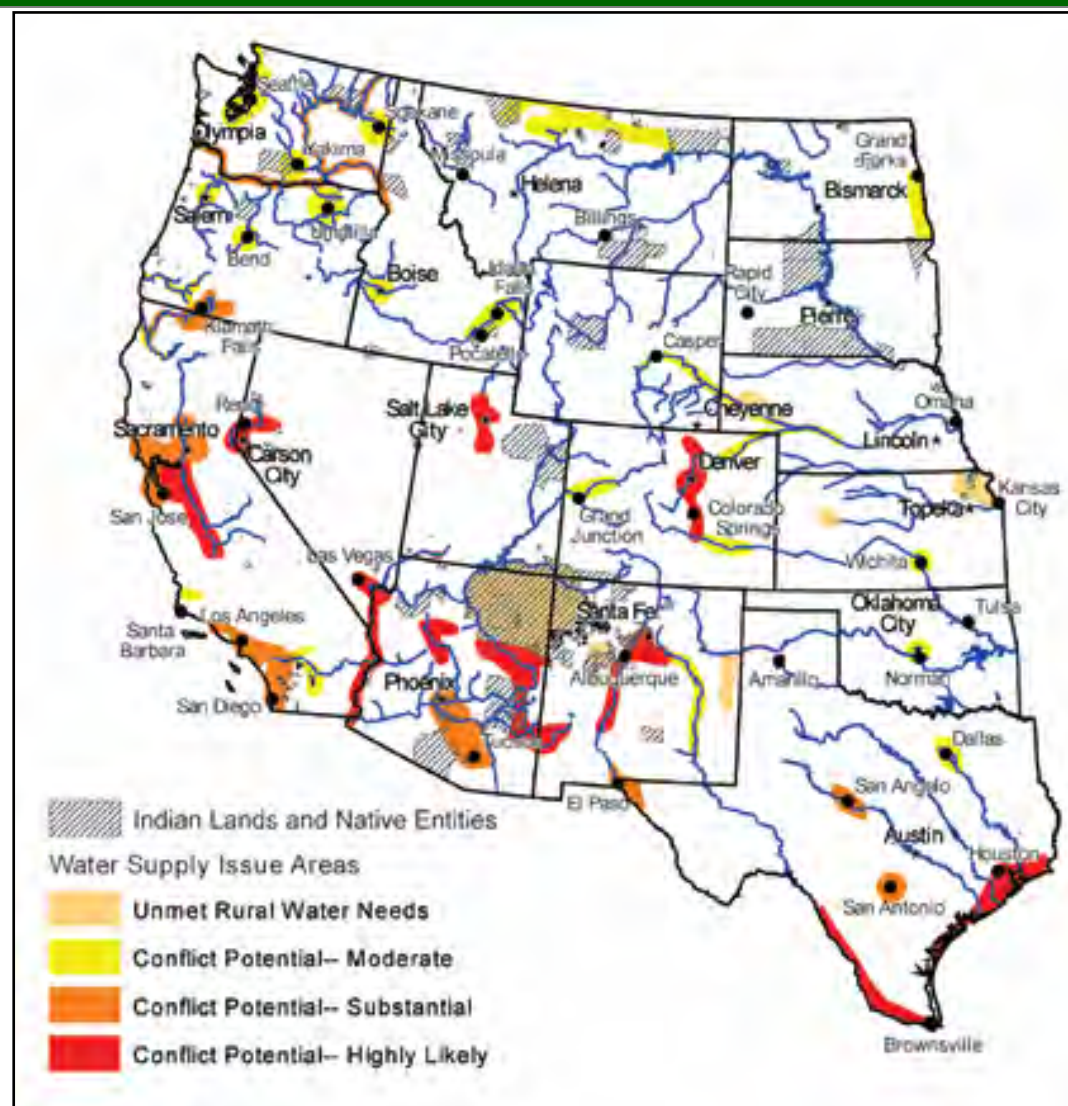
- Business as usual growth in population and energy.
- Renewable water supply based on 16 climate models.
- Water supplies in 70% of counties may be at risk to climate change.



*Tetra Tech, Inc. July 2010*



# Future Water Conflict Potential



*U.S. Global Change Program, 2009*



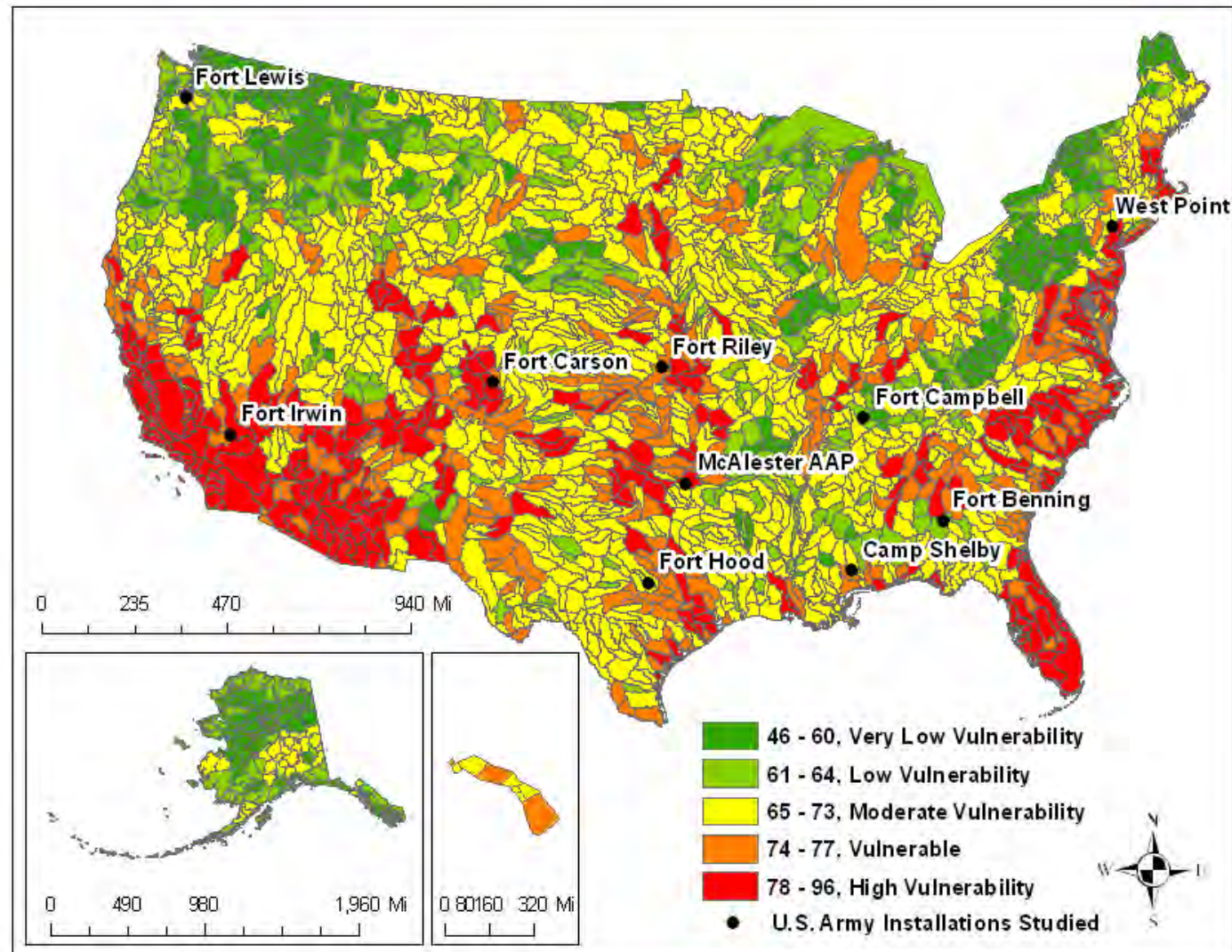
# Water Sustainability Assessments

- Assess long-term water supply and demand for 15 regions with Army installations.

- Methodology developed in 2009 in two pilot studies.
- Applied to 10 domestic and 3 overseas installations.

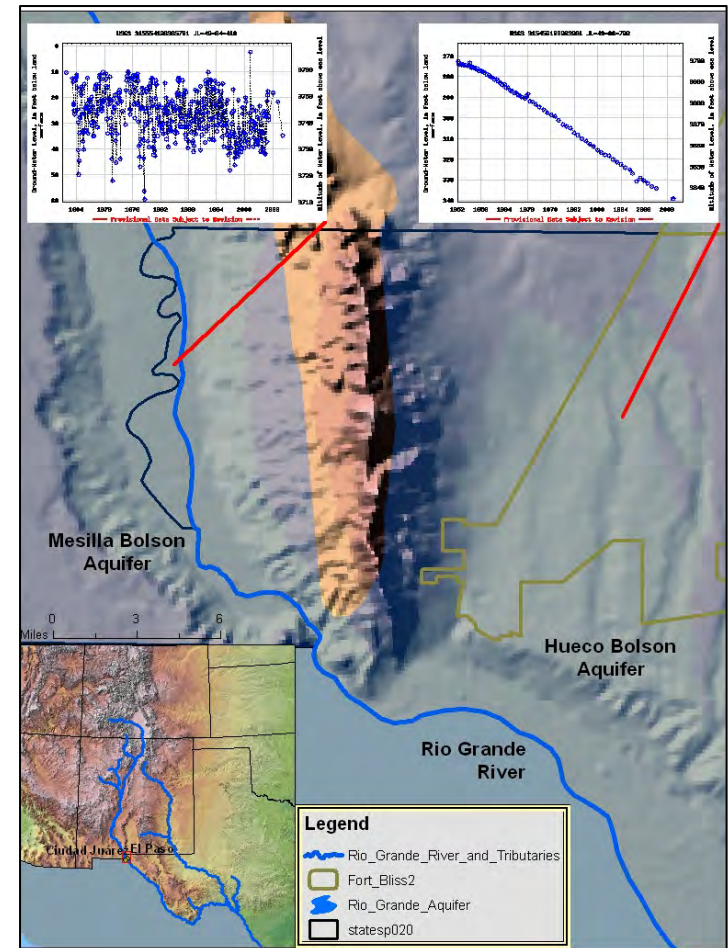
*Fort Bliss, TX*  
*Fort Bragg, NC*  
*Camp Shelby, MS*  
*McAlester AAP, OK*  
*Fort Benning, GA*  
*West Point, NY*  
*Fort Hood, TX*  
*Fort Carson, CO*  
*Fort Campbell, TN/KY*  
*Fort Riley, KS*  
*Joint Base Lewis-McChord, WA*  
*Fort Irwin, CA*  
*USAG Humphreys, Korea*  
*USAG Grafenwoehr, Germany*  
*USAG Vicenza, Italy*

# 10 CONUS Study Installations



# Fort Bliss

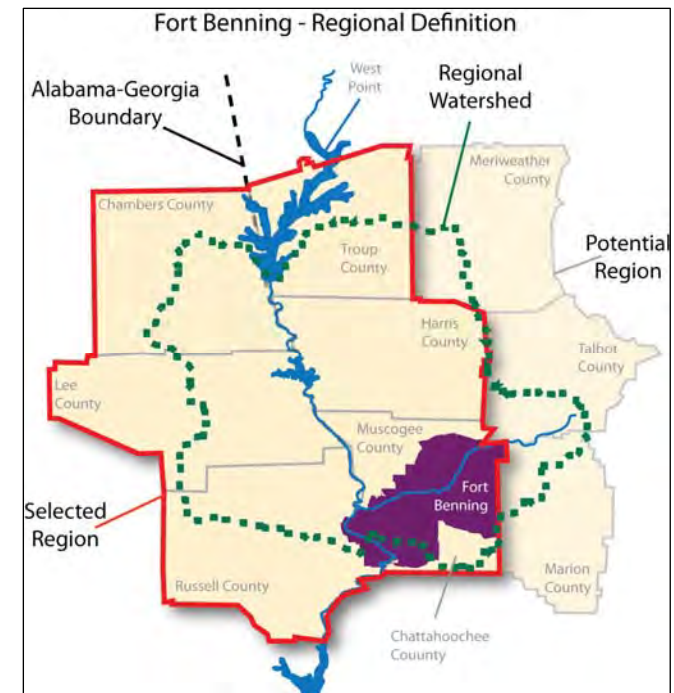
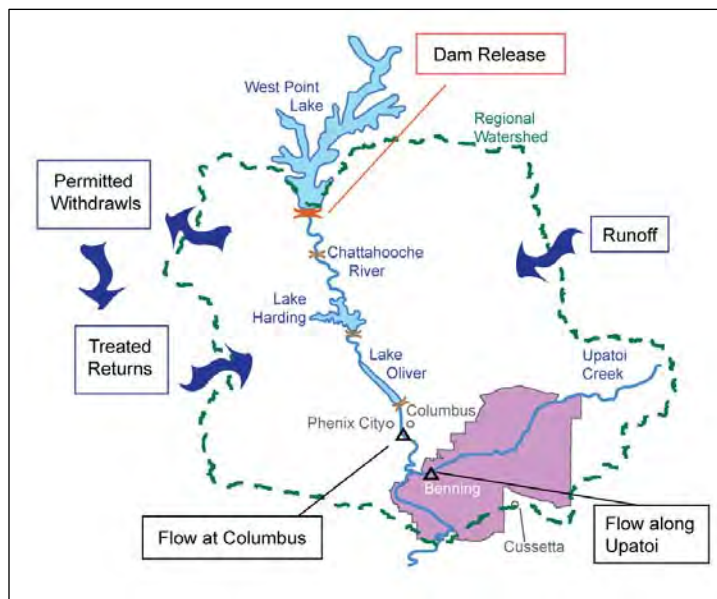
- Largest maneuver area in the U.S.
- 300% increase by 2012.
- State boundaries/International borders.
- Declining aquifers/saline wells.





# Fort Benning, GA

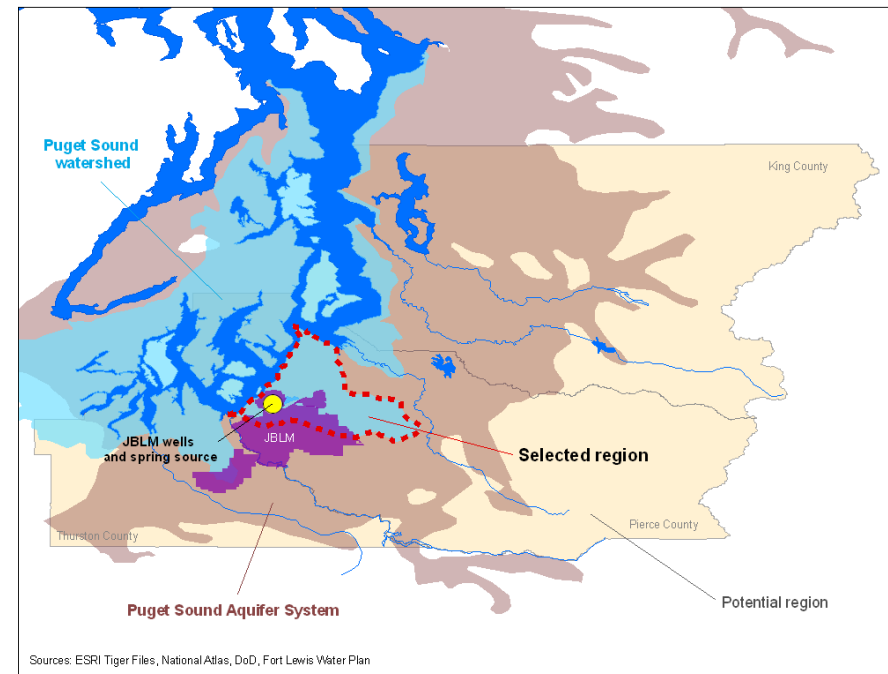
- Large influx of troops and concurrent regional growth.
- Chatahoochee River: historic water disputes.
- History of regional droughts.
- Higher temps and stronger storms.





# Joint Base Lewis-McChord, WA

- Combined Army-Air Force.
- 90,000 acres; 35,000 staff.
- High growth region.
- Inadequate recharge despite high precipitation.
- Climate scenarios call for a warmer and wetter future.



Scenarios	Baseline 2005	Climate Change 2040	Increased Demand 2040	Status Quo 2040	Water Efficiency 2040	Stormwater BMPs 2040
Aquifer recharge	68.98	62.08	65.53	65.53	65.53	75.88
Groundwater withdrawals by JBLM	4.14	3.85	3.94	3.85	3.64	3.85
Groundwater withdrawals by rest of region	69.37	84.99	90.01	84.99	63.60	84.99
<b>Net gain in aquifer supply</b>	-4.53	-26.76	-28.42	-23.31	-1.71	-12.97

# Fort Irwin & National Training Center

- 763K acres in Mojave desert: < 10 inches of rain/year.
- 22,287 permanent troops/5,200 rotational.
- Declining aquifers: arsenic, fluoride, TDS.
- Percolating T2 wastewater into Irwin Basin.
- Water rights.
- 500 MW Solar Project.
- Climate scenarios call for precipitation decrease.



# Key Issues

- Even large gains in installation water efficiency will not safeguard supplies for continued use without planning for sustainable water resources regionally.
- Climate change will exacerbate scarcity in arid regions and affect availability in historically wet regions.
- Historic water rights are limiting factors for some installations.
- A holistic approach is needed for achieving energy and water sustainability.
- The Army should take a proactive approach for installations that will experience the greatest climate-driven impacts.